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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

NGUYEN, DUNG X

ART UNIT PAPER NUMBER

2631

DATE MAILED: 03/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/671,638

Applicant(s)

AL-DHAHIR, NAOFAL

Examiner

Dung X Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 September 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 - 20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4 - 7, 10 - 12, and 20 is/are rejected.
- 7) ☒ Claim(s) 2, 3, and 13 - 19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 September 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claim 20 is rejected** under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 20, line 1, the statement of “receiver” lacks of dependent meaning. It should be changed to “receiver of claim 13”.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Monsen (US patent # 3,879,664).

Regarding claim 1, Monsen discloses (figure 1):

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- Feedforward filter structure having a plurality of filters (13s), each responsive to a signal that is derived one of the entry points (11s) and each developing an output signal that contributes to one of feedforward structure outputs (column 4, lines 24 – 36);
- Feedback filter (17) responsive to one of output signals from feedforward filter structure (figure 1, element 13(s), column 5, lines 16 – 19);
- Combining network (see figure 1, element 18) for developing signals from signals of forward filter structure outputs and feedback signal (column 5, lines 16 – 24);
- DATA OUT (see figure 1, element 16) corresponding to a decision logic in responsive to the outputs developed by the combining network (see figure 1, element 18, column 5, lines 16 – 24), for developing the output signals.

Monsen differs from the instant claimed invention that it does not show a feedback filter (17) having a plurality of filters, and the combining network (18) being the subtractor structure. However, in order to match with outputs of feedforward filters (13s) without the diversity combiner (14), the feedback filter (17) must have a plurality of filters, and changing the negative sign in the combining network (18) to eliminate the interference that will become a subtractor structure. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement Monsen to provide a feedback filter (17) having a plurality of filters and the combining network (18) being the subtractor structure for improving the high speed digital communication receiver.

4. **Claims 1, 4 – 7, and 10 - 12 are rejected** under 35 U.S.C. 103(a) as being unpatentable over Turner (US patent # 5,561,687), further in view of Friedman (US patent # 6,154,501).

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Regarding claim 1, Turner discloses (figure 4):

- Feedforward section (51) having M taps (it would have been obvious to one of ordinary skill to make a plurality of FIR filter instead of taps);
- Feedback section (57) being responsive to output signal having N taps (it would have been obvious to one of ordinary skill to make a plurality of FIR filter instead of taps);
- Subtractor (56) that develops signal from feedforward filter structure (51) output and feedback filter (57); and
- Decision output responsive to the output developed by the subtractor (56) via slicer (59), for developing the output signal.

Turner differs from the instant claimed invention that it does not show that feedforward section (51) having a $n_0 \times n_i$ plurality of FIR filters that each responsive to a signal that is derived from one of n_0 entry points and each developing an output signal that contributes to one of n_i feedforward structure output, feedback section (57) having an $n_i \times n_i$ plurality of FIR filters, subtractor (56) that develops n_i signals from signals of n_i feedforward section (51) and n_i feedback section (57), and data decisions (58) responsive to the outputs developed by subtractor (56), for developing the n_i signals. However, Turner develops a receiver for single signal going through M taps feedforward section (51), subtractor (56), output decision (58), and feedback section (57), which performs the same basic of the instant claimed invention, so, it would have been obvious to one of ordinary skill in the art to develop a plurality of feedforward filters, subtractors, output decisions, and feedback filters to develop the multiple signals for multiple users.

Besides that, Friedman discloses (figure 1) block Multiple Beam Antenna (see figure 1, element 30) having outputs 1, 2, 3, 4 corresponding to a multiple (n_0) entry points. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine Turner and Friedman to provide feedforward section (51) having a $n_0 \times n_i$ plurality of FIR filters that each responsive to a signal that is derived from one of n_0 entry points and each developing an output signal that contributes to one of n_i feedforward structure output, feedback section (57) having an $n_i \times n_i$ plurality of FIR filters, subtractor (56) that develops n_i signals from

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signals of n_i feedforward section (51) and n_i feedback section (57), and data decisions (58) responsive to the outputs developed by subtractor (56), for developing the n_i signals to provide to multi-users having multi-inputs and multi-outputs.

Regarding claim 4, Turner further discloses blocks 53, 54, 56, 61, 63, 64 corresponding to a processor coupled to a signals applied to feedforward section (51) and feedback section (57) for computing coefficients in feedforward section (51) and feedback section (57).

Regarding claim 5, Turner differs from the instant claim invention that it does not show wherein the coefficients computed in blocks 53, 54, 56, 61, 63, 64 in response to a block of N_f symbols. However, Turner discloses all N taps of feedback section (57) is responsive to N_f (58), and as analyzed in the manner set forth in claim 1. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement Turner to provide wherein the coefficients computed in blocks 53, 54, 56, 61, 63, 64 in response to a block of N_f symbols for providing to multi-users having multi-inputs and multi-outputs.

Regarding claims 6 and 7, respectively, Turner differs from the instant claim invention that it does not show wherein the coefficients computed in blocks 53, 54, 56, 61, 63, 64 in a non-iterative manner as substantial in claim 6 or a non-iterative equation as substantial in claim 7. However, the coefficients are computed in a non-iterative manner or equation depending on hand of one of ordinary skill in the art depending on the designed choice. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement Turner to provide wherein the coefficients computed in blocks 53, 54, 56, 61, 63, 64 in a non-iterative manner as substantial in claim 6 or a non-iterative equation as substantial in claim 7 for designed choice.

Regarding claims 10, Turner differs from the instant claim invention that it does not show where the FIR filters in feedforward section (51) form an array of filters that includes one FIR filter connected between each of the n_o input points and the n_i outputs. However, Frieddman provides (figure 1) multiple n_o input points (1, 2, 3, 4) and as analyzed in the manner set forth in

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claim 1. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine Turner and Friedman to provide where the FIR filters in feedforward section (51) form an array of filters that includes one FIR filter connected between each of the n_o input points and the n_i outputs providing the complete set of communication system for multi-users having multi-inputs and multi-outputs.

Regarding claim 11, Friedman further discloses multiple beam antenna 30 including n_o plurality received signals (1, 2, 3, 4) via a transmission channel (28a, 28b, 28c, 28d) having a multiple number of transmitting antennas (14a, 14b, 14c, 14d). Friedman differs from the instant claimed invention that it does not show each entry point of received signals (1, 2, 3, 4) being a single antenna. However, Friedman discloses a multiple beam antenna (30) for performing the same function of instant claimed invention. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement Friedman to provide plurality received signals (1, 2, 3, 4) via a transmission channel (28a, 28b, 28c, 28d) having a multiple number of transmitting antennas (14a, 14b, 14c, 14d) since it performs the same function of the instant claimed invention.

Regarding claim 12, Friedman further discloses where the transmitter (28a, 28b, 28c, 28d) has n_i transmitting antennas (14a, 14b, 14c, 14d).

Allowable Subject Matter

5. **Claim 20 would be allowable** if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

6. **Claims 2, 3, 8, 9, 13 – 19 are objected** to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Documents:

Lee (US patent # 6,570,919 B1) discloses an iterative decoding of data packets employing decision feedback equalization.

Harman (US patent # 6,442,198 B1) discloses a method and its corresponding apparatus for stabilizing a decision feedback equalizer.

Jonsson et al. (US patent # 6,414,990 B1) discloses a timing recovery for a high-speed digital data communication system based on adaptive equalizer impulse response characteristic.

Patel (US patent # 6,222,592 B1) discloses a TV receiver equalizer storing channel characterizations for each TV channel between times of reception therefrom.

Gelfand et al. (US patent # 6,144,697) discloses equalization techniques to reduce intersymbol interference.

Ghosh (US patent # 6,011,813) discloses a blind equalization method and its corresponding apparatus having reduced complexity.

Goldstein et al. (US patent # 6,002,713) discloses a PCM modem equalizer with adaptive compensation for robbed bit signaling.

Shiue et al. (US patent # 5,712,873) discloses a multi-mode equalizer in a digital video signal processing system.

Amrany et al. (US patent # 5,371,762) discloses technique utilizing signal storing devices for canceling signal dispersion

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Bonn et al. (US patent # 4,281,411) discloses an improved high speed digital communication diversity receiver.

Other Publication:

Ariyavisitakul et al., "Tap-Selectable Decision Feedback Equalization", IEEE International Conference on Communications, 1997, ICC 97 Montreal, vol. 3, 8 – 12 June 1997, pp. 1521 – 1526.

Ariyavisitakul et al., "Reduced-Complexity Equalization Techniques for Broadband Wireless Channels", IEEE Journal on Selected Areas in Communications, 1997, vol. 15, no. 1, January 1997, pp. 5 - 15.

Roy et al., "Multi-User Decision-Feedback Space-Time Equalization and Diversity Reception", Vehicular Technology Conference, 1999 IEEE 49th, vol. 1, 16 – 20 May 1999, pp. 494 - 498.

Contact Information

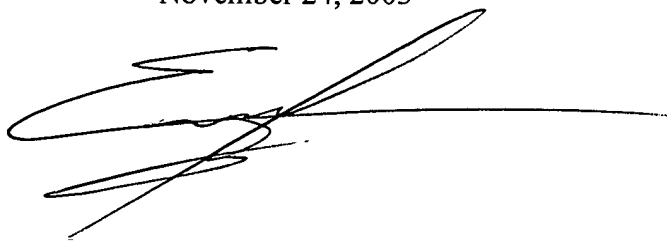
8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung X. Nguyen whose telephone number is (703) 305-4892. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Ghayour Mohammad H. can be reached on (703) 306-3034. The fax phone numbers for this group is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3800.

DXN

November 24, 2003

A handwritten signature in black ink, consisting of a series of loops and a long horizontal stroke extending to the right.